

New books on physics and related sciences

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Einstein Albert, Infeld Leopold *Evolution of Physics: The Growth of Ideas from Early Concepts to Relativity and Quanta* (New Eureka series; Translated from English by S G Suvorov) (Saint-Petersburg: Amphora Publ. House, 2013) 304 pp., ISBN 978-5-367-02491-3.

Albert Einstein, best known as the creator of the special and general theories of relativity, became perhaps the most famous scientist of the 20th century, the epitome of human genius. He changed in the most drastic manner our understanding of the essence of matter, space, and time. The present book, *Evolution of Physics*, written in cooperation with Leopold Infeld, was addressed to the general reader. Translated into Russian from *The Growth of Ideas from Early Concepts to Relativity and Quanta* (Cambridge: The University Press, 1938) (Izdatel'skii Dom Amfora: 197110 Saint-Petersburg, naberezhnaya Admirala Lazareva 20; tel./fax +7 (812) 331-16-91; URL: <http://amphora.ru/>)

Katanin A A, Irkhin V Yu, Igoshev P A *Modeling Approaches to the Magnetism of Two-Dimensional Band Systems* (Moscow: Fizmatlit, 2013) 176 pp. ISBN 978-5-922114-25-7.

This book describes theoretical approaches to the description of magnetism of low-dimensional band systems and can serve as an introduction to the complex and beautiful physics of such systems. Beginning with the presentation of Stoner's and Overhauser's classical theories and attracting readers' attention to less well-known specifics of the application of these theories, the authors then outline consecutively the derivation of the spin-fermion model, which allows them to reproduce the results of the familiar Murata–Doniah, Dzyaloshinskii–Kondratenko, and Moriya theories, and, on the other hand, go beyond their frames, for example, to describe the influence of incommensurable fluctuations beyond the mean field theory. Also given are the renormgroup approach, dynamic mean field theory, and dynamic tip approximation, which have become popular recently. The book contains numerous examples and results of the application of the theories mentioned above, mostly obtained in the authors' original publications. The book is intended for specialists working on the physics of strongly correlated systems, for newly qualified researchers (students and postgraduates), as well as for anyone interested in the condensed matter physics. (Izdatel'stvo Fizmatlit: 117997 Moscow, ul. Profsoyuznaya 90; tel. +7 (495) 334-74-21; fax: +7 (495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

Surdin V G (Compiler/Editor) *Galaxies* (Astronomy and Astrophysics series) (Moscow: Fizmatlit, 2013) 431 pp. ISBN 978-5-922114-45-5.

This book appeared in the Fizmatlit's Astronomy and Astrophysics series. It includes a review of modern concepts of the giant stellar systems we call galaxies. The galaxy story is outlined through the history of the discovery of galaxies, and their main classification types and systems. The fundamentals of the dynamics of stellar systems are presented. The galactic neighborhoods closest to us are described in detail, as is work on the global study of galaxies. Data are presented on different types of galactic populations — stars, the interstellar medium, and dark matter. Specific features of high-energy galaxies and quasars are characterized, together with an outline on the origin of galaxies. The book is intended for junior undergraduates in natural science departments and specialists in related branches of science. It will be of special interest for amateur astronomers. (Izdatel'stvo Fizmatlit: 117997 Moscow, ul. Profsoyuznaya 90; tel. +7 (495) 334-74-21; fax: +7 (495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

Beletskii V V *Essays on the Motion of Bodies in Space* 4th ed. (Synergetics: From Past to the Future series, issue 40) (Moscow: URSS, 2013) 426 pp. ISBN 978-5-397-03757-0.

This book is composed of a number of studies on interesting problems concerning the mechanics of space flight and celestial mechanics. They deal with various problems of the trajectory mechanics of space flight, the evolution of orbits of artificial and natural celestial bodies, and the resonance phenomena we encounter there; a description is provided of the original problems of relative motion in an orbit and many others. A parallel presentation is given for the required mathematical apparatus, although the main emphasis is on bringing out the mechanical spirit of the problems. The book is intended for anyone interested in or specializing in the field of space flight, particularly fresh researchers in the field, and students in the relevant branches of specialization. Vladimir Vasil'evich Beletskii is one of the leading authorities on celestial mechanics, solid state dynamics, and the mechanics of space flight; he has a DSc in physics and mathematics, was elected a RAS Corresponding Member and Full Member of the International Academy of Astronautics and the K E Tsiolkovsky Russian Academy of Astronautics, is a Principal Researcher of the M V Keldysh Institute of Applied Mathematics of the RAS, is a professor in the Mechanics and Mathematics Department of Lomonosov Moscow State University. He also received the F A Tsander (Russia) and the A von Humboldt (Germany) Prizes. (Izdatel'skaya gruppa URSS: 117335 Moscow, Nakhimovskii prosp. 56; tel. +7 (499) 724-25-45; e-mail: urss@urss.ru; URL: <http://urss.ru>)

Zhdanov V M, Galkin V S, Gordeev O A, Sokolova I A *Physical and Chemical Processes in Gas Dynamics* Vol. 3 *Models of Processes of Molecular Transfer in Physical and Chemical Gas Dynamics* Handbook (Edited by S A Losev) (Moscow: Fizmatlit, 2012) 282 pp. ISBN 978-5-922111-58-4.

Volume 3 of the handbook *Physical and Chemical Processes in Gas Dynamics* provides information on the models of molecular transfer processes in gases and plasmas. Balance equations are given for the number density of particles, mass, momentum, energy, and entropy in gases and plasmas, the thermal and caloristic equations of state, as well as the linear transfer relations that close the set of equations. Methods are described for solving the Boltzmann kinetic equation — the Chapman–Enskog and the Grad method of moments. Expressions are given for transfer coefficients in gases and their mixtures, obtained within a number of Chapman–Cowling approximations. Formulas are given for a number of model interaction potentials; these allow the researcher to calculate Omega integrals entering into the expressions for transfer coefficients. The library of transfer coefficient models includes approximate formulas for their calculation. Various methods of describing the transfer properties of molecular excited gases are presented. Single-liquid and multiliquid models of plasma are also shown. Finally, expressions are given for transfer coefficients in weakly ionized and in fully ionized plasmas. Reviewed by a RAS Corresponding Member, DSc, Prof. U G Pirumov, and DTSc, Prof. E V Samuilov. (Izdatel'stvo Fizmatlit: 117997 Moscow, ul. Profsoyuznaya 90; tel. +7 (495) 334-74-21; fax: +7 (495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

Vedyaev A V, Kotel'nikova O A, Ryzhanova N V *Spin-Dependent Transport in Magnetic Nanostructures* (Moscow: Moscow State University Publ., 2012) 141 pp. ISBN 978-5-211-06214-6.

This textbook is devoted to theoretical methods of describing spin transport in multilayer magnetic nanostructures and to implementing such structures in a new field of solid-state electronics — spintronics. The quantum-statistical approach is considered for calculating the electrical conductivity tensor of metal systems based on the Kubo formalism and the Green's function method. A review is given of the new effects employed in spintronics; among other things, the book considers in detail giant magnetoresistance, tunneling magnetoresistance, and the quasi-two-dimensional Hall effect. The textbook brings together the texts of the lectures 'Introduction to Spintronics and Spintronics', delivered to students, experts, masters-degree candidates, and postgraduates in the Faculty of Physics of Lomonosov Moscow State University. It can be useful to physicists (both theorists and experimentalists) working in today's solid-state electronics. The textbook is recommended for publication by the Learned Council of the Faculty of Physics of Moscow State University. (Izdatel'stvo MGU: 125009 Moscow, ul. B Nikitskaya 5/7; tel. +7 (495) 629-50-91; e-mail: secretary-msu-press@yandex.ru; URL: <http://msupublis-hing.ru/>)

Golitsyn G S *Statistics and Dynamics of Natural Processes and Phenomena: Techniques, Tools, Results* 2nd stereotyped ed. (Synergetics: from the Past to the Future series, issue 68) (Moscow: URSS, 2013) 398 pp. ISBN 978-5-396-00502-0.

Most natural processes are stochastic in nature and are described by the probability distributions and by their moments: mean values, dispersion, spectra, and higher-order moments. Quite often, empirical distributions in definite intervals have a power-law form: the laws of small-scale turbulence; frequency vs energy distributions of earth-

quakes, volcanic eruptions and inundations; cosmic ray spectra, and a number of other phenomena. The book offers methods for studying such processes, and explains in a unified manner the forms of the above distributions (for the first time in the case of the last four processes, as well as for a number of other ones). The fundamentals of the probability theory and stochastic processes, the theory of similarity and dimensionality, the construction of general models for explaining the results of observations are highlighted; as are the 'rules of the fastest response of a system to external actions' and 'random walks in momentum space' approaches formulated by the author. The author's earlier results can now be regenerated from these general positions: the theory of similarity of the general circulation of planetary atmospheres, the convection and turbulence of rotating liquids, and many others; all of this is illustrated with specific examples from the natural environment. Among the new results, Golitsyn also deals with the energy cycle of seawave generation, the propagation of admixtures in the field of random wind waves, certain quantitative conditions of hurricane seeding, and the problem of the evolution of galaxies and their clusters. The book is intended for a broad range of researchers, students, and postgraduates who are interested in the interpretation of both specific and general regularities observed in Nature, and in the methods of studying and comprehending their causes. (Izdatel'skaya gruppa URSS: 117335 Moscow, Nakhimovskii prosp. 56; tel. +7 (499) 724-25-45; e-mail: urss@urss.ru; URL: <http://urss.ru>)

Kiselev V V, Dolgikh D V *Nonlinear-Elastic Patterns of Dents on the Surface of Loaded Plates and Shells* (Moscow: Fizmatlit, 2012) 164 pp. ISBN 978-5-922114-37-0.

This monograph develops special versions of the reductive perturbation theory, which allow the authors to bring three-dimensional dynamic equations of the nonlinear theory of elasticity for plates, layered medium and shells to the simpler two-dimensional and one-dimensional models. First orders of such a theory reduce to traditional equations for plates and shells. New essentially nonlinear models are obtained, which correctly take into account the boundary conditions on surfaces of specimens, the interaction between longitudinal and transverse modes of material strain, the geometrical and physical nonlinearities of the medium, and changes in the inertial properties of surfaces that are deformed due to local changes in their curvature. On this foundation, patterns formed by dents and new types of solitons are described analytically; they are formed on the surfaces in such systems at the initial (nonlinear-elastic) stage of changes in their shape. The monograph is addressed to researchers, postgraduates, and undergraduate students specializing in the appropriate fields of science. (Izdatel'stvo Fizmatlit: 117997 Moscow, ul. Profsoyuznaya 90; tel. +7 (495) 334-74-21; fax: +7 (495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

Kirichenko N A *Thermodynamics and Statistical and Molecular Physics* Textbook for universities. (MIPT; Physics series) 4th ed., revised and enlarged. (Moscow: Fizmatkniga, 2012) 192 pp. ISBN 978-5-89155-207-4.

This book provides the main definitions and formulas of thermodynamics and statistical and molecular physics studied in the course of general physics. Given in detail are the

principles of thermodynamics and statistical physics, as well as examples of applying them to solving specific problems. It deals with the theory of heat capacitance and thermal fluctuations. Much attention is focused on transfer processes: heat transfer, diffusion, and viscosity. Separate chapters are devoted to the theory of phase transitions and to surface phenomena. The textbook was prepared on the basis of lectures that the author gave to students at the Moscow Institute of Physics and Technology (State University) and was adjusted to the demands of students in lower-level courses on this subject, and was also designed as a reference material for students and teachers. (Izdatel'stvo Fizmatkniga: ul. Pervomaiskaya 11-a, 141700 Moskovskaya obl., g. Dolgoprudnyi; tel. +7 (495) 971-26-04; e-mail: publishers@mail.mipt.ru; URL: <http://www.fizmatkniga.ru/>)

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